Original Research Article

Effect of Nano urea and Zinc on Growth and Yield of Baby Corn (*Zea mays* L.) under Prayagraj Condition

Abstract

A field experiment was conducted at the Crop Research Farm (CRF), Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of *Kharif* season 2022. The experiment comprised of ten treatments of different combinations of Nanourea and Zinc nutrient management replicated thrice in a Randomized Block Design. The main objective of the experiment was to evaluate the "Response of Nano urea and Zinc on growth and yield of Baby corn (*Zea mays* L.)" Prayagraj condition. The three level of nano urea levels N_1- 1 ml/l foliar spray nano urea, N_2 -2 ml/l foliar spray nano urea and N_3 - 3 ml/l foliar spray nano urea. Whereas three levels of zinc include like Z_1- 20 kg/ha zinc, Z_2- 25 kg/ha zinc and Z_3- 30 kg/ha zinc. From the present investigation it may be concluded that the profitable production of baby corn can be secured by Zinc application 30 kg/ha + Nanourea 3 ml/lt. (T_9). Highest Gross returns (92087.17 ₹/ha), Net returns (61352.17 ₹/ha) and B:C ratio (2.00)were recorded significantly high with the application of Zinc application 30 kg/ha + Nano urea 3 ml/lt.

Keywords: Growth, yield, nano urea spray and zinc levels

Introduction

Maize is one of the most important cereal crops next to rice and wheat in world agriculture economy both as food for men and feed for animals. It has high yield potential, there is no crop on earth which has so immense potentiality and that is why it is called queen of cereals. Its botanical name is *Zea mays* L. belonging to the family Gramineae, sub family Poaceae and chromosome number is 20 (2n). Christopher Columbus reported that maize was cultivated in Halti, where it was named "mahiz". He carried maize from America to Europe and later it was carried by Portuguese and others Europeans to Africa and Asia, during 16^{th} and 17^{th}

centuries. During recent times, its potentiality has been extended to the field of vegetable production **(Mugalkhod *et al.* 2011).** In India, cultivation of baby corn is a recent development and its industry is still at a juvenile stage. Its cultivation is only now picking up seriously in Meghalaya, Western UP, Haryana, Maharashtra, Karnataka and Andhra Pradesh. In India, maize (*Zea mays* L.) is grown on an area of 9.43 m/ha, with production and productivity of 24.35 mt and 2583 kg/ha, respectively (GOI, 2014). Baby corn grown for vegetable purpose is successful in countries like Thailand, Taiwan, Srilanka and Burma. It has been developed into a multi-dollar business because of its potential as a value-added product for export and a good food substitute.

Nitrogen, a key vital ingredient needed for a plant's healthy growth and development, may be found in Nano Urea (Liquid). A plant's amino acids, enzymes, genetic material, photosynthetic pigments, and energy transfer molecules are all heavily reliant on nitrogen. As it supports precise and sustainable agriculture, nano urea is a potential part of the 4 R approach to nutrient stewardship. According to testing carried out by NABL approved and GLP certified laboratories, Nano urea has been deemed safe for both users and the environment. Therefore, Nano Urea represents a potential, long-term, and environmentally benign alternative to bulk nitrogenous fertilizers like Urea. An important nutrient for plants is zinc (Zn). After nitrogen, phosphorus, and potassium, zinc is now ranked as the fourth most significant nutrient in India that limits crop yields. In many enzymatic and physiological processes that occur in plants, zinc and iron play a vital role. Zinc catalysis the oxidation process in plant cells, which is essential for the transformation of carbohydrates, controls the consumption of sugar, increases the energy source for chlorophyll synthesis, aids in the formation of auxins, which leads to the production of more plant cells and more dry matter, which is then stored in seeds as a sink and encourages water absorption. **Ojha *et al.* (2018)**

The following objectives have been undertaken to study the “Effect of nano urea and zinc on growth and yield of baby corn (*Zea mays* L.) Under prayagraj condition”

Materials and Methods

The current study was carried out at Crop Research Farm of Sam Higginbottom University, Prayagraj, Uttar Pradesh during the *Kharif* season 2022. The experimental field is situated on the left side of the Prayagraj-Rewa Road, about seven kilometers from Prayagraj city and close to the Yamuna River, at 25.57o N latitude, 87.19o E longitude and at an altitude of 98m above mean sea level. The relative humidity levels range from 79.11% and 37.60%. In this location, the average annual rainfall is of 3.42 mm in June and zero rainy days were occurred in July and August months, respectively. The soil chemistry analysis revealed a sandy loam texture with a pH of 7.20, low amounts of organic carbon (0.72 percent) and potassium (233.24 kg/ha), and a low quantity of accessible phosphorus (27.80 kg/ha). The soil was electrically conductive and had a conductivity of 0.187 dS/m. For each of the ten treatment combinations, three replications were employed. The therapy details and treatment ombinations are shown in Tables 1 and 2, respectively. Nano urea and zinc were maintained according to the treatment combinations. Plant height (cm) at harvest, dry weight at harvest, number of cobs/plant, weight of cob (g), baby corn yield (t/ha) and fodder yield (t/ha) were all successfully measured, and an economic analysis of each treatment was completed to determine the best treatment combination for baby corn cultivation. The collected data was subjected to statistical analysis by analysis of varience method **(Gomez and Gomez, 1976).**

Result and Discussion

Pre - harvest Parameters:

The perusal of data indicate that plant height measured at (i.e., 60 DAS) was not influenced markedly by the application of different levels of nano urea and zinc, though, the Data indicated that significant impact on plant height during the crop growth period. Application of T_9- Zinc application 30 kg/ha + Nano urea 3 ml/lt. significantly influenced the plant height in baby corn at 60 DAS. The maximum plant height (175.25 cm) was recorded in T_{10}- Zinc application 30 kg/ha + Nano urea 3 ml/lt, which was statistically at par with T_8,T_7,T_6 and minimum plant height (120.33 cm) was recorded in application of T_{10} : Control (RDF). Significantly dry weight (70.50 g) was recorded in T_9: Zinc application 30 kg/ha + Nano urea 3 ml/lt. Were statically at par with T_8 and lowest dry weight (46.99 g) was recorded in Farmers practice- urea (120:60:40 kg/ha N, P and K).

Application of Zn enhances hotosynthesis, activates several enzymes, and aids in assimilate transport to the stem. The physiology and morphology of plants are greatly influenced by zinc. Foliar spraying of nano urea drastically reduced plant height**.** A similar finding was also made by **(Akongwubel *et al.* 2012).** They observed a significant improvement in maize plant height and leaf area index with an increase in organic manure rates. The essential nutrients for supporting healthy growth and physiological functions in the plant system are provided by nitrogen. When the rate of bio fertilizer application is raised, plant height, leaf area index, and dry matter output are all significantly increased. **(Igua *et al.* 2009)** and both observed the same result **(Channal, 2017)**. The availability of sufficient space, nutrients, and sunlight may have encouraged plants to grow vertically, leading to higher plant height. The current findings closely resemble those of **Qodliyati *et al.* (2018), Ojha *et al.* (2018), and Ganvit *et al.* (2017).** When nano urea were applied, the physico-chemical characteristics of the soil may have improved, giving the soil a favorable structure for root growth and soil enzymes (which continue to decompose organic matter in the soil to release nutrients and make them available near the rhizosphere for absorption by plant roots, thus improving quality) **(Chaoui *et al.* 2003).** Increased photosynthetic activity will lead to larger plant organs, which will also result in a rise in the dry weight of plants. According to **Meena *et al.* (2012), Kumar *et al.* (2014), Shahid *et al.* (2015),** others, proper nutrition and spacing promote higher vegetative development and more sunshine to plants.

Post-harvest parameters

The information on the number of cobs per plant impacted by treatments is reported in a table for in general. The number of cobs per plant rose with crop stage progression regardless of treatment and peaked at harvest. Number of cobs per plant recorded non-significant difference among the treatments. Zinc application 30 kg/ha + Nano urea 3 ml/lt. recorded maximum number of cobs (2.47/plant) and minimum was recorded in control plot (1.15/plant), respectively. Maximum cob length (17.83 cm) was recorded in Zinc application 30 kg/ha + Nano urea 3 ml/lt. However, treatments of Zinc application 30 kg/ha + Nano urea 2 ml/lt., Zinc application 30 kg/ha + Nano urea 1 ml/lt. and Zinc application 25 kg/ha + Nano urea 3 ml/lt. (16.13, 15.58 and 15.33 cm) were found to be at par with the treatment of Zinc application 30 kg/ha + Nano urea 3 ml/lt. A significant difference was appeared in relation to cob girth. Significantly higher cob girth (8.65 cm) was recorded in Zinc application 30 kg/ha + Nano urea 3 ml/lt. which was on par with Zinc application 30 kg/ha + Nano urea 2 ml/lt., Zinc application 30 kg/ha + Nano urea 1 ml/lt. and Zinc application 25 kg/ha + Nano urea 3 ml/lt. (8.46, 8.06 and 7.56 cm) treatment combinations. Cob weight per plant with husk recorded a significant difference among treatment combinations.

However, cob weight (45.22 g) recorded significantly higher in Zinc application 30 kg/ha + Nano urea 3 ml/lt. and at par values were observed in Zinc application 30 kg/ha + Nano urea 2 ml/lt., Zinc application 30 kg/ha + Nano urea 1 ml/lt. and Zinc application 25 kg/ha + Nano urea 3 ml/lt. (42.12, 38.31 and 33.54 g/plant), respectively. Significantly higher cob weight without husk was (17.77 g) recorded significantly higher in Zinc application 30 kg/ha + Nano urea 3 ml/lt. which was followed by Zinc application 30 kg/ha + Nano urea 2 ml/lt., Zinc application 30 kg/ha + Nano urea 1 ml/lt. and Zinc application 25 kg/ha + Nano urea 3 ml/lt. (16.10, 15.55, 15.30 and 14.84 g/plant), respectively. Significantly higher green cob yield with husk was noticed in Zinc application 30 kg/ha + Nano urea 3 ml/lt. (6.38 t/ha) which was on par with followed by Zinc application 30 kg/ha + Nano urea 2 ml/lt., Zinc application 30 kg/ha + Nano urea 1 ml/lt. and Zinc application 25 kg/ha + Nano urea 3 ml/lt. (5.98, 5.65, 5.42 and 5.06 t/ha), respectively. However, green cob yield without husk (8.88 t/ha) was found to be significantly higher in treatment combination of Zinc application 30 kg/ha + Nano urea 3 ml/lt. which was statistically at par with Zinc application 30 kg/ha + Nano urea 2 ml/lt., Zinc application 30 kg/ha + Nano urea 1 ml/lt. and Zinc application 25 kg/ha + Nano urea 3 ml/lt. (8.48, 8.15, 7.92 and 7.56 t/ha), respectively.

The overall growth of the crop was significantly enhanced by providing the crop with the nutrients it requires from the start and increasing the supply of N, P, and K in a more coordinated manner at the treatment receiving an integrated supply of nutrients from nano urea, as measured by plant height, cobs per plant, cob girth, cob length, and cob weight with and without husk by virtue of inorganic fertiliser, chemical fertiliser, and integrated use of fertilizer, **singh *et al.*, (2015).** The decrease in cobs might be due to more fertilizer per plot in the experiment. As a result cobs present in less fertilizer was found to be more than the highest fertilizer. Similar findings were under the conformity of **Longchar *et al.* (2021).** Higher chlorophyll contents were the cause of the increase in yield attributes brought on by the application of zinc, and this appeared to have a favorable impact on photosynthetic activity, the synthesis of metabolites and growth-regulating substances, oxidation and metabolic activities, and ultimately better crop growth and development, which brought about the increase in yield attributes of baby corn. The results were in conformity with **Meena *et al.* (2013).** Baby corn yield may have increased due to the beneficial effects of applied zinc on plant physiological and metabolic processes. Although wider intra-row spacing was found to significantly increase all growth and yield attributes, it was determined that narrower spacing could outperform others in terms of yield. It was found that crops with tight intra-row spacing produced better yields than those with wider intra-row spacing. Higher zinc applications were also found to be strongly associated to the crop's vegetative and reproductive growth phases. Similar results were obtained by **Kumar *et al.* (2014).** In case of green fodder yield, almost the same trend was observed in case of green cob yield. Plant population showed significant differences in green fodder yield the lowest being recorded with the wider spacing. The present findings are well in agreement with that of **Kumar *et al*. (2016) and Kour *et al*. (2017).**

Conclusion

On the basis of results obtained in present investigation, it is concluded that the profitable production of baby corn can be secured by Zinc application 30 kg/ha + Nano urea 3 ml/lt. (T_9). These practices may be passed on to the farmers for obtaining higher returns in this agro-climatic zone. It has also recorded the maximum gross return, net return and benefit cost ratio.

References

Akongwubel, A. O., U. B. Ewa, A. Prince, O. Jude, A. Martins, O. Simon and O. Nicholas. (2012). Evaluation of agronomic performance of maize (*Zea mays* L.) under different rates of poultry manure application in an ultisol of Obubra, cross river state, Nigeria. *International Journal of Agriculture and Forestry;* **2**(4): 138-144.

Channal, B. K. (2017). Effect of organic and inorganic sources of nutrients on soil fertilitand productivity of maize (*Zea mays* L.). (Doctor of science), University of Agriculture Science, Dharwad.

Ganvit, J. B., Sharma, S., Vaishali, H. S., and Ganvit, V. C. (2019). Effect of sowing dates and crop spacing on growth, yield and quality of linseed under south Gujarat condition *Journal of Pharmacognosy and Phyto-chemistry*.**8**(1): 388-392.

Gomez, K. A. and Gomez, A. A., (1976). Three or more factor experiment. (In) Statistical Procedure for Agricultural Research 2nd ed.139-141.

Igua, P., L. Huasi, E. H. P. Goroka and P. N. Guinea. (2009). Effect of chicken manure, *Tithonia diversifolia* and *Albizzia spp.* on maize plant height and dry matter production–lessons learnt in the eastern highlands of PNG. Paper presented at the 17th International Farm Management Congress, Bloomington/Normal, Illinois, and USA.

Longchar, Joy Dawson and Lipi Rina (2021). Effect of plant geometry and organic manure on growth and yield of baby corn (*Zea mays* L.). *The Pharma Innovation Journal;* **10**(11): 892-895.

Kour J, Himani K, Singh CP, Jain N. (2017). Effect of plant densities and integrated nutrient management on productivity, nutrient uptake and quality of sweet corn (*Zea mays* L. Saccharata). *Journal of Agricultural and Veterinary Science*; **12**(5): 38-42.

Kumar R, Bohra J. S. (2014). Effect of NPKS and Zn application on growth, yield, economics and quality of baby corn. *Archives of Agronomy and soil science*. **60**(9): 1193-1206.

Kumar, V.M., Velayutham, A., Kumar, S. N. and Vasanthi, D. (2018). Influence of Different Organic Manures on the Growth and Yield of Baby Corn, *International Journal of Advances in Agricultural Science and Technology.* **5**(7): 167-174.

Lone, A. A., Allai, B. A. and Nehvi F. A. (2013). Growth, yield and economics of baby corn (*Zea mays* L.) as influenced by Integrated Nutrient Management (INM) Practices. *African Journal of agricultural Research*; **8**(37):4537-4540.

Meena, S. R., Kumar, A., Jat, B. P., Meena, B. P., Rana, D. S. and Idanani, L. K. (2012). Influence of nutrient sources on growth, producyivity and economics of baby corn (*Zea mays* L.)-Potato (*Solanum tuberosum*)-mung bean (*Vigna radiate*) cropping system. *Indian Journal of Agronomy*; **57**(3): 217-221.

Mugalkhod, A.S., Shivamurthy, D., Kumar, A. and Biradar, M.S. (2011). Yield components of baby corn (*Zea mays* L.) as affected by planting method and irrigation schedule under drip. *Plant Achives.* **11**(1): 379-381.

Ojha, E., Adhikari, B., and Katuwal, Y. (2018). Nurient Management Trial on Foxtail Millet at Sundarbazar, Lamjung. *Journal of the Institute of Agriculture and Animal Science.* **35**(1): 89-94.

Qodliyati, M., S., Nyoto, S., (2018). Influence of spacing and depth of planting to growth and yield of arrowroot (*Marantha arundinacea*). IOP Conf. Series: *Earth and Environmental Science*, 142.

Sahid, R., S., Kanth, R., Hamid, S., Alie, B. A., Raja, W., & Dar, Z. A. (2016). Effect of Integrated Nutrient Management on Yield and Yield Attributes of Sweet Corn (*Zea mays* L. saccharata) Under Wet Temperate Conditions of Western Himalayas (India). *Journal of Experimental Agriculture International*, **13**(2): 1-9.

Singh, A. K., Kumar, R., Bohra, J. S. and Kumawat, N. (2015). Fodder yield, nutrient uptake and quality of baby corn (*Zea mays* L.) as influenced by NPKS and Zn fertilisation. *Research on Crops*, **16**(2): 243-249.

Wailare, A.T. and Kesarwani, A. (2017). Effect of integrated nutrient management on growth and yield parameters of maize (*Zea mays* L.) as well as soil physicochemical properties.

Table 1: Effect of nano urea and zinc on growth parameters of baby corn

Treatment details	Growth Parameters	
	Plant height (cm)	**Plant dry weight (g/plant)**
Zinc application 20 kg/ha + Nanourea 1 ml/lt	123.11	49.79
Zinc application 20 kg/ha + Nanourea 2 ml/lt.	126.36	53.03
Zinc application 20 kg/ha + Nanourea 3 ml/lt.	128.69	54.57
Zinc application 25 kg/ha + Nanourea 1 ml/lt.	131.13	55.56
Zinc application 25 kg/ha + Nanourea 2 ml/lt.	131.61	56.74
Zinc application 25 kg/ha + Nanourea 3 ml/lt.	138.29	58.29
Zinc application 30 kg/ha + Nanourea 1 ml/lt.	140.04	60.04
Zinc application 30 kg/ha + Nanourea 2 ml/lt.	147.21	67.21
Zinc application 30 kg/ha + Nanourea 3 ml/lt.	175.25	70.25
Control (RDF)	120.33	46.99
F Test	S	S
SEm (±)	4.03	3.82
CD (p= 0.05)	11.97	11.36

Table 2: Effect of nano urea and zinc on yield attribute and yield of baby corn

Treatment details	Yield attribute and yield						
	No. of cobs/plant	Cob length (cm)	Cob grith (cm)	Cob weight with husk (g)	Cob weight without husk (g)	Cob Yield without husk (t/ha)	Cob Yield with husk (t/ha)
Zinc application 20 kg/ha + Nanourea 1 ml/lt	1.56	11.37	5.25	26.38	11.34	4.37	6.43
Zinc application 20 kg/ha + Nanourea 2 ml/lt.	1.61	12.62	6.06	27.68	12.59	4.30	6.47
Zinc application 20 kg/ha +Nanourea 3 ml/lt.	1.71	13.80	6.27	28.59	13.77	4.51	6.68
Zinc application 25 kg/ha + Nanourea 1 ml/lt.	1.99	14.03	6.69	30.15	14.00	4.69	6.86
Zinc application 25 kg/ha + Nanourea 2 ml/lt.	2.11	14.87	7.24	32.49	14.84	5.06	7.56
Zinc application 25 kg/ha + Nanourea 3 ml/lt.	2.22	15.33	7.56	33.54	15.30	5.42	7.92
Zinc application 30 kg/ha + Nanourea 1 ml/lt.	2.42	15.58	8.06	38.31	15.55	5.65	8.15
Zinc application 30 kg/ha + Nanourea 2 ml/lt.	2.43	16.13	8.46	42.12	16.10	5.98	8.48
Zinc application 30 kg/ha + Nanourea 3	2.47	17.83	8.65	45.22	17.77	6.38	8.88

ml/lt.							
Control (RDF)	1.15	9.60	4.23	24.86	9.57	4.24	6.42
F Test	S	S	S	S	S	S	S
SEm (±)	0.22	1.20	0.78	4.33	1.21	0.48	0.50
CD (p= 0.05)	0.66	3.59	2.32	12.89	3.60	1.43	1.49